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## (54) Screw-threaded closure-container assembly

(57) To achieve a screw-threaded container and closure having a non-backoff feature which locks the container and closure internally to avoid unwanted loosening, a plug type seal on the closure (14) is used in conjunction with a bead (20) on the inside of the neck (16) of the container (12). An annular flange (30) of the plug, having a downwardly converging cam surface (34), diverges outwards to provide an axially downward closing force against the bead (20) which seals and resists unscrewing of the closure from the container.

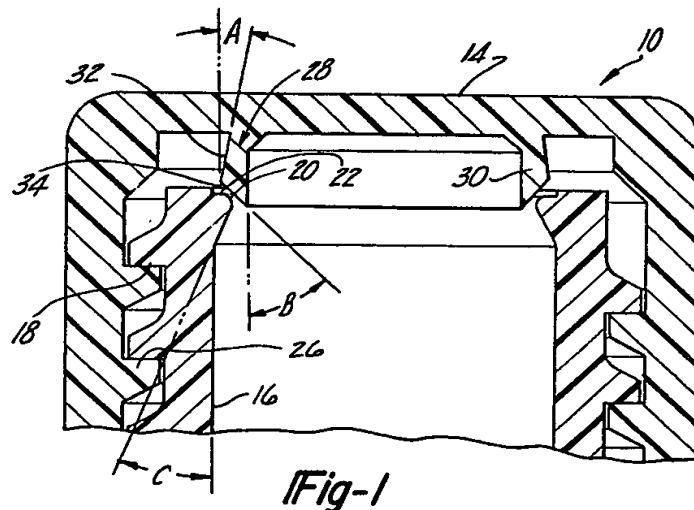


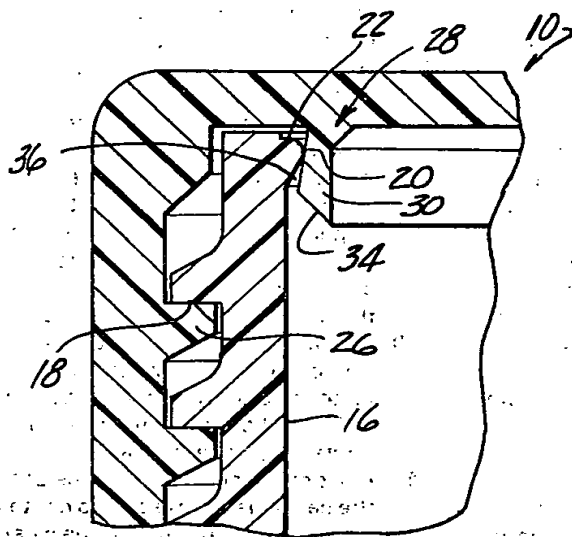
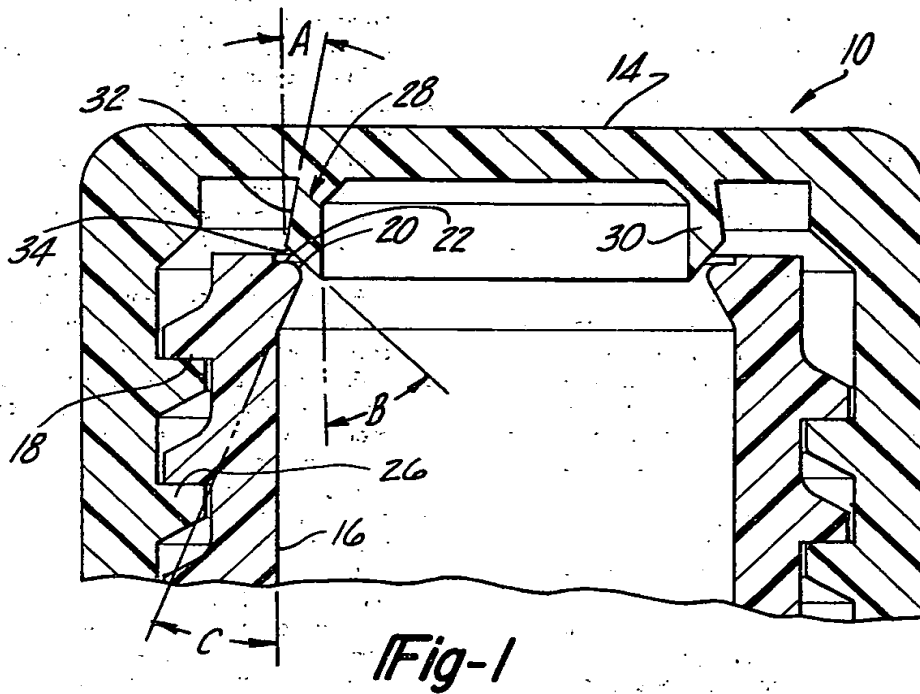
Fig-1

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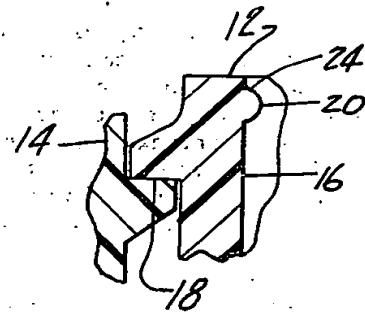
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**Fig-3**



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## SPECIFICATION

### Screw-threaded closure-container assembly

5 This invention relates to screw-threaded containers and closures, and more particularly to the type having means in addition to the screw-thread engagement to hold the closure in sealing engagement with the container.

10 In some forms of screw type containers and closures, particularly in the so-called child-resistant or safety packages, it is common to provide in addition to the screw-threads, means such as an external annular bead at the open end of the container to engage complementary means such as an annular collar on the closure cap to apply an axial force which aids in sealing the surfaces on the closure and container and acts to resist the tendency of the closure to loosen or turn in an opening direction. This resistance to opening or unscrewing is frequently referred to as a non-backoff system, and when the bead on the container co-operates with a flange on a collar on the closure the system is commonly referred to as a snap retention system which adds to the sealing force generated by the screw-threads on the closure and the container.

Proper operation of the snap retention system requires the dimensions of the container and closure to be maintained within narrow limits. It is, therefore, a general aim of this invention to provide a screw-threaded container and closure assembly having a non-backoff feature which does not require the maintenance of close tolerances.

It is a specific object of this invention to provide a threaded closure with a plug type seal which is modified to provide a non-backoff feature without the use of an external collar and flange.

The object of this inventions are accomplished by providing a container with a screw-threaded neck forming an opening with an annular bead formed on the inside of the neck adjacent to its open end. A cup-shaped cap having internal threads to engage the threads on the neck of the container is provided with a plug seal member which has a downwardly diverging annular flange. This flange provides a radially outwardly facing conical friction surface for engagement with the annular bead on the container. The lower end of the flange is provided with a downwardly converging cam surface which co-operates with the bead to guide the plug into the container as the cap is screwed onto the container. The conical friction surface created by the depending flange of the plug seal is disposed at an angle of  $7^\circ$  to  $30^\circ$  to the longitudinal axis of the container, preferably at  $15^\circ$ , to optimise the generation of a downward sealing force as the cap is screwed onto the container. The end of the flange is directed inwards at a converging angle of  $10^\circ$  to  $45^\circ$  to the longitudinal axis of the container, preferably at  $30^\circ$  to provide the cam surface with a low friction guide surface for the bead on the container. The bead on the container can have a full radius so as to form an inwardly projecting toroidal surface for engagement with the surfaces of the flange without the interference that might be caused by contact of a portion of the flange

with the inside wall of the container. Instead of a full radius bead, an upwardly facing quarter-circle bead can be employed in conjunction with a lower relief surface extending away from the radius towards the inside wall of the container at an angle of  $10^\circ$  to  $60^\circ$  to the longitudinal axis of the container, preferably at an angle of  $30^\circ$ , to avoid such interference of the flange with the inside diameter of the container.

The presently preferred embodiment of the invention is illustrated in the accompanying drawings in which:

*Figure 1* is an elevational view in cross-section of the container and closure embodying the invention in a position in which the cap is being screwed onto the container but before contact is made between the plug seal flange and the internal container bead;

*Figure 2* is a fragmentary cross-sectional view similar to *Figure 1* showing the closure cap and the container in its fully sealed position; and

*Figure 3* is a fragmentary cross-sectional view similar to *Figure 1* showing an alternative embodiment in which a full radius bead is employed on the inside of the container neck.

The container and closure assembly is shown generally at 10 and includes a container 12 and a closure cap 14.

The container 12 can be in the form of a bottle having a neck 16 formed with external screw-threads 18. The container 12 has formed on the inside of neck 16 an annular bead 20 which is adjacent to the open end of the container. The bead 20 may take the form of an upwardly facing quarter circle radius 22 as shown in *Figures 1* and 2, or a full radius so as to form an inwardly projecting toroidal surface 24 as shown in *Figure 3*. The cap 14 has internal screw-threads 26 to mate with complementary threads 18 on the container and a downwardly depending plug seal 28 having an annular flange 30 which diverges as it extends away from the top surface of the cap to form an outer conical friction surface 32 for sealing engagement with the annular bead 20. The lower end of the flange 30 is formed with a downwardly converging cam surface 34 which co-operates with the bead 20 in guiding the plug into the container as the cap is screwed onto the container. The conical friction surface 32 created by the depending flange 30 of the plug seal 28 is disposed at an angle A of  $7^\circ$  to  $30^\circ$  to the longitudinal axis of the neck of the container, preferably at  $15^\circ$ , to optimise the creation of a downward sealing force against the bead 20, as the cap 14 is screwed onto container 12, which acts to resist the tendency of the closure to loosen or turn in an opening direction, giving the closure and container the desired non-backoff feature. The lower cam surface 34 on flange 30 is formed with a downwardly converging angle B of  $10^\circ$  to  $45^\circ$  with the longitudinal axis of the container to provide a guiding surface with a minimum amount of frictional resistance upon which the bead 20 will ride as the cap is tightened onto the container. Once the bead has passed the cam surface 34 to engage the conical friction surface 32, it is important that the flange is not distorted away from the bead by contact with the neck 16 of the container. In the embodiment shown in *Figures 1* and 2, the bead 20 is formed as an

- upwardly facing quarter circle radius for sealing engagement with the conical surface 32 and a relief surface 36 extends downwards towards the inside of container neck 16. This relief surface is preferably at an angle C of  $10^\circ$  to  $60^\circ$  to the longitudinal axis of the container (preferably  $30^\circ$ ), in order to provide full sealing contact of the bead with the conical surface whilst avoiding any further contact of the flange with the inside surface of the container.
- 10 An alternative configuration for the bead 20 is shown in Figure 3 in which the bead is formed with a full radius so as to provide an inwardly projecting toroidal surface for sealing against the conical friction surface without any other part of the flange
- 15 contacting the inside of the neck.

#### CLAIMS

1. A container and closure assembly comprising, in combination; a container having an externally screw-threaded cylindrical neck portion forming an opening, and an annular bead on the inside wall of the neck adjacent its open end; a cup-shaped cap member having internal screw-threads to engage the threads on the neck of the container and a plug seal member having a downwardly diverging annular flange with a radially outward facing conical friction surface for engagement with the annular bead, the lower end of the flange having a downwardly converging cam surface for co-operating with the bead to guide the plug into the container as the cap is screwed onto the container, the co-operation of the bead with the conical friction surface exerting a force to pull the cap down on the container in a sealed position.

2. A container and closure assembly according to claim 1 in which the conical friction surface makes an angle of  $7^\circ$  to  $30^\circ$  with the longitudinal axis of the neck of the container and the cam surface makes an angle of  $10^\circ$  to  $45^\circ$  with that axis.

3. A container and closure assembly according to claim 2 in which the conical friction surface makes an angle of substantially  $15^\circ$  with the longitudinal axis of the neck of the container and the cam surface makes an angle of substantially  $30^\circ$  with that axis.

4. A container and closure assembly according to any one of claims 1 to 3 in which the bead has a full radius so as to form an inwardly projecting toroidal surface for sealing against the conical friction surface on the cap member.

5. A container and closure assembly according to any one of claims 1 to 3 in which the bead has an upwardly facing quarter circle radius with a lower relief surface extending away from that radius toward the inside wall of the neck.

6. A container and closure assembly according to claim 5 in which the lower relief surface extends away from the said radius towards the inside wall at an angle of  $10^\circ$  to  $60^\circ$  to the longitudinal axis of the neck.

7. A container and closure assembly according to claim 6 in which the said relief surface angle is substantially  $30^\circ$ .

8. A container and closure assembly substantially as described with reference to the accompanying drawings.

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